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Specification and Drawings, as originally filed, with Application for Patent Serial No:
2,451,641, on January 9, 2004, by **ALBERTA RESEARCH COUNCIL INC.**, assignee of
Fred Wassmuth and Laurie A. Hodgins, for "Method of Placing Blocking Gel in Gas
Producing Formations in Order to Reduce Water Influx into the Well Bore".

Sharon Pauline
Agent certificateur/Certifying Officer

February 11, 2005

Date

Canada

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ABSTRACT OF THE DISCLOSURE

A method of placing blocking gel in gas producing formations in order to reduce water influx into the well bore. A first step involves injecting slugs of gelant into a gas well. A second step involves injecting slugs of foam into the gas well to over-displace gelant from the well bore and into a desired orientation in the gas producing formation to block water influx.

TITLE OF THE INVENTION:

Method of placing blocking gel in gas producing formations in order to reduce water influx into the well bore

5 **FIELD OF THE INVENTION**

The present invention relates to method of placing blocking gel in gas producing formations in order to reduce water influx into the well bore.

10 **BACKGROUND OF THE INVENTION**

Excessive water influx into a well bore can cause natural gas wells to stop producing gas. Even though producible gas reserves exist in the surrounding reservoir, water loads up the well bore and reservoir pressure is insufficient to lift both the water and gas to surface.

15 One approach in dealing with this problem has been to place a blocking gel in the gas producing formation in order to reduce the water influx into the well bore. Correct placement of the blocking gel is critical. For situations in which water is coming from below, the blocking gel needs to be placed below the perforations to block the water successfully. The perforations must stay open to allow continued gas production after the blocking gel
20 treatment.

The current field treatment recommends that slugs of gelant be injected into the gas well followed by slugs of gas. The results obtained from the use of this method of placing the blocking gel have not been satisfactory.

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SUMMARY OF THE INVENTION

What is required is an alternative method of placing blocking gel in gas producing formations in order to reduce water influx into the well bore.

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According to the present invention there is provided a method of placing blocking gel in gas producing formations in order to reduce water influx into the well bore. A first step

involves injecting slugs of gelant into a gas well. A second step involves injecting slugs of foam into the gas well to over-displace gelant from the well bore and into a desired orientation in the gas producing formation to block water influx.

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For reasons which will be hereinafter further described, the use of foam to displace the gelant has proven to be far superior and more versatile than displacement with gas.

BRIEF DESCRIPTION OF THE DRAWINGS

10 These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to in any way limit the scope of the invention to the particular embodiment or embodiments shown, wherein:

15 **FIGURE 1** is a side elevation view, in section, of a gas well being treated with blocking gelant in accordance with a first step of the present invention.

FIGURE 2 is a side elevation view, in section, of a gas well being treated with blocking gelant in accordance with a second step of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

20 The preferred method of placing blocking gel in gas producing formations in order to reduce water influx into the well bore will now be described with reference to **FIGURES 1** and **2**.

25 Referring to **FIGURE 1**, a first step involves injecting slugs of gelant 12 into a gas well 14. It is to be noted how gelant 12 tends to accumulate in well bore 16.

30 Referring to **FIGURE 2**, a second step involves injecting slugs of foam 18 into gas well 14 to over-displace gelant 12 from well bore 16 and into a desired orientation in gas producing formation 20 to block water influx from below (shown by arrows 22). At the present time, the best orientation is believed to be positioned in the shape of a pancake below perforation zone 24.

There are a number of advantages provided by this method. The injected foam needs to be only temporarily stable. Specifically, the foam needs only be stable long enough to displace the gelant in the near well bore region and then generate a channel through the gelant in the upper part of the reservoir. The foam should connect to the gas zone and displace the gel block downwards to block invading water. Foam propagates at an extremely low water saturation, thus the areas which were invaded by foam will also be de-saturated. If the foam exhibits only a temporary stability, then the gas will be able to flow unhindered to the well bore after treatment. The density and viscosity of the foam can be adjusted by varying the injected foam quality. The foam quality can be varied from a wet foam (low foam quality) to a dry foam (high foam quality) during the course of treatment. The foam has proven to be much more efficient than gas. The gas method of placement experienced problems due to the mobility of the gas.

The gelant formulations used are 0.05 weight percent AOS C1416 (an alpha olefin sulfonate surfactant) with 0.3 weight percent Alcoflood 935, and 0.01 weight percent AOS C1416 with 1.0 weight percent Alcoflood 935.

In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as hereinafter defined in the Claims.

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

- 5 1. A method of placing blocking gel in gas producing formations in order to reduce water influx into the well bore, comprising the steps of:
- injecting slugs of gelant into a gas well; and
 - injecting slugs of foam into the gas well to over-displace gelant from the well bore and into a desired orientation in the gas producing formation to block water influx.

